

Can HBT Parameters Reflect Initial Pressure Gradient Difference in Non-central Heavy Ion Collisions from RQMD?

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- Introduction & Motivation
- HBT Parameters In Different regions
- V_2 vs. P_t
- Summary

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Introduction

- Our Goal
- Pressure
- The shape of the reaction region(see Fig.1)
- Region Definition
 - ✦ X region: $|\phi| < 30^\circ, 150^\circ < \phi < 210^\circ$
 - ✦ Y region: $60^\circ < |\phi| < 120^\circ$
- Pressure Gradient difference

Motivation

- In high energy nuclear collisions, elliptic flow measurements show $V_2 > 0$, meaning the in-plane expansion. However, if such expansion is due to hydrodynamic or only due to collision geometry is not clear. In order to shed light on this important physics, using both the HBT and flow methods, we study non-central Au+Au collisions at RHIC energy. RQMD code was used in our study.

HBT Parameters In Different Regions

■ Data RQMD(V2.4)

- ✦ Au+Au at RHIC energy
- ✦ $b=7\sim 9$ fm, $|Y|<1.0$

■ Correlation Function (See Fig.2)

- ✦ Pion-Pion correlation
- ✦ OSL Cartesian, Gaussian fit
- ✦ No Coulomb and strong interaction

HBT Parameters In Different regions

■ $R_{o,s,l}$ vs. P_t (See Fig.3)

R_{out} : in Y region $>$ in X region

R_{side} : in X region $>$ in Y region

=>It seems that The shape of reaction region at freeze-out is similar to that of at the beginning.

=>Collision geometry dominant!

V_2^x vs. Pt in x-y plane

■ V_2^x definition

$$\div E \frac{d^3P}{d^3P} = \frac{1}{2\pi} \frac{1}{P_t} \frac{dN}{dp_t dy} [1 + 2 \sum_{n=1} V_n \cos(n\Phi)]$$

$$\div V_2 = \langle \cos(2\Phi) \rangle$$

■ V_2^x vs. Pt In X-Y Plane (See Fig. 4)

$$V_2^x < 0$$

=>the reaction region ellipse's long axis is the Y axis. Just the same result as that we got from HBT method.

V_2^p vs. P_t in Px-y plane

- V_2^p vs. P_t in Px-y Plane
(See Fig.4)

$V_2^p > 0$ and increase with P_t .
 \Rightarrow Px-y plane is ellipse and
its long axis is Px.
 \Rightarrow Expansion in X-direction.

- $|\delta P_x| > |\delta P_y|$
Q.Li, Y.Pang, N.Xu
Paper in preparation

(See talk given by Q.Li in this conf.)

V_2 vs. P_t for different b

■ Multi-impact-parameters

$b=3\sim 5$ fm $b=4\sim 6$ fm $b=5\sim 7$ fm
 $b=6\sim 8$ fm $b=7\sim 9$ fm $b=8\sim 10$ fm
 $b=9\sim 11$ fm $b=10\sim 12$ fm

■ Results(See Fig. 5)

In X-Y plane:

$V_2^x < 0$, V_2^x decrease with b

In Px-y plane:

$V_2^p > 0$, V_2^p increase with b

$\Rightarrow V_2^p$ max within $b=7\sim 9$ fm

(See Fig.6)

Summary

- We study the P_t dependence of Pion size parameters (R_o, R_s, R_l) from non-central Au+Au collisions at the RHIC energy, with $b=7\sim 9$ fm. The RQMD(2.4) model was used in this study. We also view the V_2 in x-y and Px-y plane, respectively. It is shown that the collision geometry dominant the V_2 P_t dependence, although one does see the sizable difference in the pressure gradients.